

What is claimed is:

(Claim 1) A safety restraint system for a vehicle, comprising:
a seatbelt restraint system including a seatbelt restraint for restraining an occupant and a seatbelt tension sensor for detecting a seatbelt load in said seatbelt restraint;
a variable-output airbag system for fully deploying an airbag substantially proximate to when said seatbelt restraint receives a maximum seatbelt load;
and
a controller coupled to said seatbelt restraint system and said variable-output airbag system, said controller for actuating said variable-output airbag system to deploy said airbag at an output rate during a crash event, said controller for throttling said output rate based on a current seatbelt load rate in said seatbelt during a crash event.

(Claim 2) The safety restraint system recited in claim 1 further comprising:
at least one weight sensor for measuring the weight of said occupant;
wherein said controller determines said output rate for said airbag based on said weight.

(Claim 3) The safety restraint system recited in claim 1 wherein said controller determines said output rate based on the weight of said occupant.

(Claim 4) The safety restraint system recited in claim 3 wherein said controller determines at least one of a maximum threshold and a minimum threshold for said seatbelt-tension rate based on the weight of said occupant.

(Claim 5) The safety restraint system recited in claim 4 further comprising:
at least one crash sensor for detecting a crash event and sending a crash signal to said controller;
wherein said crash signal actuates said controller to utilize said seatbelt tension sensor for detecting a first seatbelt load and then a second seatbelt load after a time interval from detecting said first seatbelt load, said controller subtracting said first seatbelt tension load from said second seatbelt tension load and then dividing the difference by said time interval for determining said current seatbelt-tension rate.

(Claim 6) The safety restraint system as recited in claim 5 wherein said controller actuates said variable-output airbag system to deploy said airbag at said output rate when said current seatbelt-tension rate is less than said maximum threshold and greater than said minimum threshold.

(Claim 7) The improved airbag system as recited in claim 5 wherein said controller increases said output rate of said variable-output airbag system when said current seatbelt-tension rate is greater than said maximum threshold.

(Claim 8) The improved airbag system as recited in claim 5 wherein said controller decreases said output rate of said variable-output airbag system when said current seatbelt-tension rate is less than said minimum threshold.

(Claim 9) The improved airbag system as recited in claim 1 further comprising:

at least one crash sensor coupled to said controller for generating a crash signal during said crash event and sending said crash signal to said controller; and

a velocity sensor coupled to said controller for detecting a velocity of the vehicle substantially proximate to said crash event and sending a velocity measurement to said controller;

wherein said controller determines said output rate of said variable-output airbag system based on said velocity measurement.

(Claim 10) A method for utilizing a seatbelt restraint system and a variable-output airbag system in combination for protecting an occupant of a vehicle, comprising:

determining an output rate of the variable-output airbag system for deploying an airbag;

detecting a crash event; and

determining a current seatbelt-tension rate in a seatbelt restraint during said crash event; and

throttling said output rate during said crash event based on said current seatbelt-tension rate;

wherein the occupant contacts said airbag when said seatbelt load reaches a maximum load.

(Claim 11) The method as recited in claim 10 wherein determining an output rate of the variable-output airbag system comprises:

measuring the weight of the occupant; and
determining said output rate based on said weight.

(Claim 12) The method as recited in claim 10 wherein determining said current seatbelt-tension rate in said seatbelt restraint comprises:

detecting a first seatbelt load;
detecting a second seatbelt load after a time interval from detecting said first seatbelt load;
subtracting said first seatbelt tension load from said second seatbelt tension load; and
dividing the difference by said time interval for determining said current seatbelt-tension rate.

(Claim 13) The method as recited in claim 12 wherein throttling said output rate during said crash event based on said current seatbelt-tension rate comprises:

comparing said current seatbelt-tension rate to at least one of a maximum threshold and a minimum threshold.

(Claim 14) The method as recited in claim 13 further comprising throttling selected from group consisting of:

increasing said output rate when said current seatbelt-tension rate is greater than said maximum threshold;
decreasing said output rate when said current seatbelt-tension rate is less than said maximum threshold; and
decreasing said output rate when said current seatbelt-tension rate is less than said minimum threshold.

(Claim 15) The method as recited in claim 10 further comprising:
determining whether said airbag has been fully deployed.

(Claim 16) A method for utilizing a seatbelt restraint system and a variable-output airbag system in combination for protecting an occupant of a vehicle, comprising:

detecting a crash event; and
measuring a vehicle velocity at said crash event;
determining an output rate of the variable-output airbag system for deploying an airbag based on said vehicle velocity;

determining a current seatbelt-tension rate in a seatbelt restraint during said crash event; and
throttling said output rate during said crash event based on said current seatbelt-tension rate;
wherein the occupant contacts said airbag when said seatbelt load reaches a maximum load.

(Claim 17) The method as recited in claim 16 wherein determining said current seatbelt-tension rate in said seatbelt restraint comprises:

detecting a first seatbelt load;
detecting a second seatbelt load after a time interval from detecting said first seatbelt load;
subtracting said first seatbelt tension load from said second seatbelt tension load; and
dividing the difference by said time interval for determining said current seatbelt-tension rate.

(Claim 18) The method as recited in claim 16 wherein throttling said output rate during said crash event based on said current seatbelt-tension rate comprises:

comparing said current seatbelt-tension rate to at least one of a maximum threshold and a minimum threshold.

(Claim 19) The method as recited in claim 18 further comprising throttling selected from the group consisting of:

increasing said output rate when said current seatbelt-tension rate is greater than said maximum threshold;
decreasing said output rate when said current seatbelt-tension rate is less than said maximum threshold; and
decreasing said output rate when said current seatbelt-tension rate is less than said minimum threshold.

(Claim 20) The method as recited in claim 10 further comprising:
determining whether said airbag has been fully deployed.